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VIC 20

Speech Synthesiser

OWNERS MANUAL

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CONTENTS

1) Turn to page 5 for your Speech Synthesiser connection details and directions of use.

2) Turn to page 2 for an interesting account of the speech synthesis technique and a fuller understanding of how and where to use allophones to create effective speech.

3) Turn to page 14 for hints on how to further improve your articulation.

4) Turn to page 17 if you wish to try an alternative method of generating speech.

Enjoy using a fun product and by all means let us know if you develop any innovative applications in the home environment.

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BACKGROUND TO ALLOPHONES

Previous alternative synthesis techniques have involved synthesizing and storing entire words as units and unless you want to use excessive memory, you are limited to a small vocabulary.
For example, PULSE CODE MODULATION (PCM) which is no more than digital recording, storage, and playback of speech waveforms, requires about 70,000 data bits/sec. of speech. Another method, LINEAR PREDICTIVE CODING (LPC) which predicts a speech sample from a weighted combination of previous samples, requires only 1000 – 2000 bits/sec. of speech. Using this method approximately 15 – 20 words can be stored in 16K bits of memory. While these methods require prodigious memory their big advantage is relatively high quality speech.

Allophone synthesis, on the other hand, has the major advantage or providing an unlimited vocabulary, since the stored units are not words but individual speech sounds (allophones). Each allophone requires a 6 bit address. Assuming that speech contains ten to twelve allophones/sec. allophone synthesis would require addressing less than 100 bits/sec. The user merely has to become familiar with the speech sounds of English **(which are different from letters)** and the allophone symbols used to represent them.
Another use for allophone synthesis is in a text-to-speech system.
One limitation of allophone synthesis however, is that, although completely understandable, the speech quality is not as good as it is for PCM or LPC., in other words it lacks intonation and character.

Language
To use the set of allophone sounds successfully there are a number of points to note.

First there is no one-to-one correspondence between written letters and the sounds of a language. Each sound in a language may be represented by more than one letter, and conversely, each letter may represent more than one sound (Examples in Table 3).
Because of these spelling irregularities one must remember to think in terms of **sounds** not letters when dealing with speech.

The second point to be made concerns segmentation of the speech signal. Speech sounds are not discrete units as beads on a string are and cannot be called by the name of a letter. In fact speech is a continuously varying signal which cannot be easily broken into distinct sound-size units. For example, if one attempts to extract the **b** sound from the word **bat** by taking successively larger chunks of the acoustic signal from the beginning of the word, one at first hears a non-speech noise, and then at some point hears **ba.**
In other words there is no point at which the **b** sound can be heard in isolation; one hears either a non speech noise or the syllable **ba.**

Finally, the most important point to make for users of an allophone set, is that the acoustic signal of a speech sound may differ depending on whether it occurs in word-initial or word-final position; or in the environment of a vowel which is articulated in the front or

back of the mouth, a long or short vowel, or a voiced or voiceless consonant. For example the initial **p** in **pop** will be acoustically different from the **p** in **spy,** and may be different from the final **p** in **pop.** Furthermore, the ear will perceive the same acoustic signal differently depending on what sounds precede or follow it.
The word **cot** can be made to sound like **cod** by lengthening the duration of the **o** and conversely the word **cod** can be made to sound like **cot** by shortening the duration of the **o.**

Phonemes of English
The sounds of a language are called phonemes and each language has a set which is slightly different from that of other languages.
(Table 1 indicates characteristics of English)

Consonants are produced by creating a constriction in the vocal tract which produces an aperiodic sound source. If the vocal chords are vibrating at the same time as in the case of the voiced fricatives (V) (DHH), (DH), (Z), and (ZH) (see Table 2) there are two sound sources: one which is aperiodic and one which is periodic.

Vowels are produced with a relatively open vocal tract and a periodic sound source (unless they are whispered) provided by the vibrating vocal chords. Vowels are classified according to whether they are long or short, whether the front or back of the tongue is high or low and whether the lips are rounded or unrounded.
In English all rounded vowels are produced in or near the back of the mouth, ie. OU,OUU, UH, OO, OR, OW.

It is useful to remember that sounds which have features in common behave in similar ways. For example the voiceless stop consonants (P), (T), (TT), (C), (CC), (K), require 50 – 80 msec of silence before them and the voiced stop consonants (B), (BB), (D), (DD), and (G), (GG), (GGG), require 10 – 30 msec of silence before them.
When you find a particular technique that works well with one sound try using that same technique with similar sounds, eg. (C) sounds good before a front vowel (EE) so it might be used before (I), (AA), (E), (XR), (A), (OO), (YR).

Allophones
Truthfully speaking a phoneme is an abstraction; a name given to a group of similar sounds in a language. Remember that (P) will be acoustically different depending on whether it occurs in word-initial or word-final position or after S. **Each of these different P's are allophones of the phoneme P.** An allophone therefore, is what occurs in the actual acoustic speech signal. A phoneme is the name of a group of allophones. It is for this reason that our inventory of English speech sounds is called an allophone set.

Extended Use of Allophone Synthesis
The allophone set (pp 10 - 11) contains two or three versions of some phonemes, ie. (H) and (HH). It is likely that you will need to use one allophone of a particular phoneme for word or syllable-initial-position. A detailed set of guidelines for using the allophones is given in Table 2. (suggestions not rules).

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For example, (DD) sounds good in initial position and (D) sounds good in final position, as in "daughter" and "collide" respectively. (Reference Table 4 for sample words). One of the differences between the initial and final versions of a consonant is that **an initial version may be longer** than the final version. Therefore to create an initial S you can use two S's instead of the usual single S at the end of a word or syllable, as in "sister" or "sense". Note that this can be done with TH and F and the inherently short vowels (see below) but with no other consonants. You will want to experiment with some consonant clusters (strings of consonants such as STR (STRong), PL (PLuto) to discover which version of the phoneme works best in the cluster. (C) sounds good before (L) as in "clown", and (K) sounds good before (W) as in "square". One allophone of a particular phoneme may sound better before or after back vowels and another before or after front vowels; (CC) sounds good before (UH) and (C) sounds good before (EE), as in "cookie". Some sounds (P), (B), (BB), (T), (D), (DD), (C), (CC), (K), (G), (GG), (GGG), (CH), and (JH) require a brief duration of silence before them. For most of these, the silence has already been added but you may decide you want to add more. Therefore there are several pauses included in the allophone set varying from 10 – 200 msec.
To create the final sounds in the words "letter" and "little" use the allophones (ER) (ERR) and (LL). The (NG) allophone obviously belongs at the ends of the words "sing" and "long", but notice that the NG sound is represented by the letter N in "uncle"; and remember that some sounds may not even be represented in words by any letters, as the (Y) in "computer".

As mentioned earlier there are some vowels which can be doubled to make longer versions for stressed syllables. These are the inherently short vowels (A), (E), (I), (O), (U), and (UH). For example, in the word "extent" use one (E) in the first syllable, which is unstressed and two (E)'s in the second syllable which is stressed. Of the inherently long vowels there is one, (OU) which has a long and short version. The short one, (OU), sounds good after (Y) in computer; the long version (OUU) sounds better in monosyllabic words like "two". Included in the vowel set is a group called R – coloured vowels. These are vowel + R combinations clearly seen as (AR) in "alarm" and (OR) in "score". Of the R – coloured vowels there is one (ER) which has a long and short version, the short version is ideal for polysyllabic words with final ER sounds like "letter", and the long version (ERR), is good for monosyallabic words like "fir". One final suggestion is the usefullness of adding a pause of 30 – 50 msec between words when creating sentences, and a pause of 100 – 200 msec between clauses.

* * * * * * *

CONNECTION INSTRUCTIONS

The Speech Synthesis cartridge plugs directly into the back of the VIC 20 computer or into one of the slots on the Expansion Motherboard.

1) Turn off the power to the VIC.
2) Push the cartridge firmly into the expansion slot at the back right corner of the VIC making sure that the label is facing up, or in the case of our Motherboard, towards you.
3) The cartridge also has 2 connection leads with integral 5 pin connectors. The **plug** connector fits into the VIC in place of the TV modulator plug lead which itself connects with the second cartridge lead having a 5 pin socket.
4) Turn on the power. The VIC will spring to life with the familiar Commodore message followed by a further definitive heading.
5) The keyboard will now talk when keys are pressed.

DIRECTIONS FOR FUN

The operating software is initialised on power up (the operating system resides at $A000 – A7FF. Immediately you will find it is possible to initiate a response from the VIC 20 by pressing any of the keys on the keyboard. (Press any key now and make sure the TV volume is correctly set). If the F1 key from the right hand set of 4 function keys is pressed the letters will be voiced phonetically as small children learning to read would pronounce them. Pressing the F1 key once more restores normal pronunciation.

Moving on to the creation of words from an infinite English vocabulary and a more limited foreign language capability we begin by pressing F3 key followed by the return key. The cursor should be at the left hand edge and we are now in a position to voice the word of our choice by entering a string of allophones. There are 64 allophones to choose from (see pages 10/11). For example type in the allophones H/E/LL/OO/, notice how the allophones develop allowing constructive alteration to take place at any point during the input. NB. (Each allophone must be followed by the separator sign /.) Alterations to a word are easy. Now press RETURN and disregard the syntax error notation. Typing in the allophones to represent the word CHEEKY might be attempted as CH/EE/K/EE/ (Remember that you must think of a word as it sounds and not as it is written). Suppose you wish to try the allophones C/ or CC/ in place of K/; use the 'delete' key 5 times and re-enter your alternative choice of allophones, it will probably be CH/EE/CC/EE/. To seperate words you should use a pause, the allophones P1 – P5 provide 5 pauses of different lengths. For long intervals of silence use

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one or more of the P5 allophone seperated by "/". The pause allophones might be useful for deciding the better of two allophone strings e.g. O/V/P5/P5/P5/0/F/. Carrying on with another word to follow CHEEKY you could have the following string CH/EE/CC/EE/P5/CH/A/TT/ER/B/O/K/S/ (you may return to the previous mode at any time by typing "F1" again). If you continue to enter allophones a point (approx. 30 of them) is reached where the allophones are no longer voiced, due to a lack of space in each operating storage block.
You must now turn to the use of string formatting and the command SYS 41000. SYS 41000 is a key command and enables a string to be voiced. Begin by pressing the RUNSTOP and RESTORE keys simultaneously to disable the voicing of the keyboard when keys are pressed. The simplest program will illustrate the use of strings and the SYS command.

```
e.g.   10 A $ = "H/E/LL/OO/"
       20 SYS 41000
```

Type RUN and the word hello will be voiced.

A further programming example might be to add the following lines.

```
 5  FOR x = 1TO 4
25  NEXT
```

Type RUN and you initiate a loop sequence.

Remember you are allowed approximately 30 allophones/ string. Therefore for longer sentences it is necessary to use more than one string, each string must have the SYS 41000 command associated with it.

Here is another program for you to try. First press F3 (just to make the entry of this program silent)

```
10  FOR S = 1 TO 6
20  FOR X = 1 TO 1200  :  NEXT
30  A $ = "CH/EE/CC/EE/"
40  SYS 41000
50  IF A=Ø THEN 70
60  FOR D = 1 TO 1000 : NEXT
70  B $ = "CH/A/TT/ER/B/O/K/S/"
80  SYS 41000
90  IF A = Ø THEN A = 1 : NEXT
95  IF A = 1 THEN A = Ø : NEXT
```

Now press RUN and RETURN for a demonstration. Repeat as often as you wish. You are now in a position to write your own voice software but may first like to look at the programs on pages 9 & 16.

HELPFUL HINTS. Whenever a program is RUN, the previously typed RUNSTOP RESTORE command is automatically lost and the Speech Synthesiser software is re-initialised. This can be a nuisance if you were originally in F1 mode because when a program

is RUN, any alteration in the program involving pressing keys results in the key being voiced. The answer in this case is to enter F3 mode before typing RUNSTOP RESTORE or after the program has RUN. In effect the disabling action of RUNSTOP RESTORE is only operable until a program is RUN. Thereafter the keyboard returns to the state of F1 or F3 mode. So before writing a program it simplifies your activities if you'enter the F3 mode before typing RUNSTOP RESTORE.

A useful program for assigning allophone strings to string variables; typical application in a Spell and Speak program on which a teacher may wish to test her young students.

```
  5 FOR A = 1 TO 4
 10 PRINT "TYPE YOUR WORD"      (e.g. HELLO)
 20 INPUT A$(A)
 30 PRINT "PRONUNCIATION"       (e.g. H/E/LL/OO/)
 40 INPUT B$(A)
 50 NEXT
100 FOR B = 1 TO 1000 : NEXT
200 FOR C = 1 TO 4
210 PRINT A$(C)" ";
220 B$(C)=B$(C)
230 SYS 41000
240 NEXT
```

The command SYS41000 will voice each string stored in turn.

NOTE The last variable used in the program is the string that is voiced hence the dummy argument in line 220.

To escape the functions provided by "FI and F3" keys press "stop/ restore" together (alternatively type SYS41003) (the SYS41000 command will still work).

To re-initialise FI — type SYS41006
F3 — type SYS41009

To cancel FI/F3 — type SYS 41003
(or stop/restore)

To voice "F1" phonetically without typing "F1" (after initialising)

POKE 674,128

To voice "FI" normally without typing "FI"

POKE 674,Ø

NOTE. Each string will hold approximately 30 allophones before running out of space.

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TABLE 1 – CONSONANT PHONEMES OF ENGLISH**

		Labial	Labio-Dental	Inter-Dental	Alveolar	Palatal	Velar	Glottal
Stops:	Voiceless	P			T,TT		K,C,CC	
	Voiced	B,BB			D,DD		G,GG,GGG	
Fricatives:	Voiceless	WH	F	TH	S	SH		H,HH
	Voiced		V	DH,DHH	Z	ZH*		
Affricates:	Voiceless					CH		
	Voiced					J		
Nasals:	(Voiced)	M			N,NN		NG*	
Resonants:	(Voiced)	W			R,RR,L,LL	Y,YY		

Labial: Upper and lower lips touch or approximate

Labio-Dental: Upper teeth and lower lip touch

Inter-Dental: Tongue between teeth

Alveolar: Tip of tongue touches or approximates alveolar ridge (just behind upper teeth)

Palatal: Body of tongue approximates palate (roof of mouth)

Velar: Body of tongue touches velum (posterior portion of roof of mouth)

Glottal: Glottis (opening between vocal cords)

* These do not occur in word-initial position in English

** Examples of these phonemes in word context can be found in Table 2.

THE SPEAKING CLOCK

```
10 DIMT$(100)
20 T$(0)="OO/"
30 T$(1)="W/U/N/"
40 T$(2)="TT/OUU/"
50 T$(3)="TH/ER/RR/EE/"
60 T$(4)="F/OR/"
70 T$(5)="F/F/II/V/"
80 T$(6)="S/S/I/K/S/"
90 T$(7)="S/S/E/V/E/N/"
100 T$(8)="AA/TT/"
110 T$(9)="NN/II/N/"
120 T$(10)="TT/E/E/N/"
130 T$(11)="EE/L/E/V/ER/N/"
140 T$(12)="TT/W/E/L/L/F/"
150 T$(13)="TH/ER/TT/EE/NN/"
160 T$(14)="F/OR/TT/EE/N/"
170 T$(15)="F/I/F/T/EE/N/"
180 T$(16)="S/I/CC/S/TT/EE/N/"
190 T$(17)="S/S/E/V/E/N/TT/EE/N/"
200 T$(18)="AA/TT/EE/N/"
210 T$(19)="NN/II/N/TT/EE/N/"
220 T$(20)="TT/W/E/N/TT/EE/"
230 T$(21)="TH/ER/TT/EE/"
240 T$(22)="F/OR/TT/EE/"
250 T$(23)="F/I/F/TT/EE/"
260 W$(1)="OW/ER/"
270 W$(2)="TT/II/M/"
280 W$(3)="I/I/S/S/"
285 W$(4)="A/A/N/DD/"
290 W$(5)="S/S/E/K/U/N/DD/"
300 W$(6)="P/ER/EE/S/II/S/L/EE/"
310 W$(7)="OO/C/L/O/K/"
400 A$=W$(1):SYS41000
410 A$=W$(2):SYS41000
420 A$=W$(3):SYS41000
430 H$=MID$(TI$,1,2)
440 M$=MID$(TI$,3,2)
450 S$=MID$(TI$,5,2)
460 H=VAL(H$)
470 M=VAL(M$)
480 S=VAL(S$)
490 IFH>12THENH=H-12
500 IFH=0THENH=12
510 X=H:GOSUB1000
520 IFM=0THENA$=W$(7):SYS41000:GOTO550
530 IFM<10THENX=0:GOSUB1000
540 X=M:GOSUB1000
550 IFS=0THENA$=W$(6):SYS41000:GOTO600
555 A$="P5/":SYS41000
560 A$=W$(4):SYS41000
565 A$="P5/":SYS41000
570 X=S:GOSUB1000
580 A$=W$(5):SYS41000
590 IFS<>1THENA$="S/":SYS41000
600 FORA=0TO3000:NEXT
610 GOTO400
1000 IFX=50>=0THENX=X-50:A$=T$(23):GOTO1060
1010 IFX=40>=0THENX=X-40:A$=T$(22):GOTO1060
1020 IFX=30>=0THENX=X-30:A$=T$(21):GOTO1060
1030 IFX=20>=0THENX=X-20:A$=T$(20):GOTO1060
1040 A$=T$(X):SYS41000
1045 A$="P5/":SYS41000
1050 RETURN
1060 SYS41000
1065 A$="P4/":SYS41000
1070 IFX=0THEN1045
1080 GOTO1040
```

TI$= 390042 EG TI$= 142530 Direct command to initialise clock

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SPEECH SYNTHESISER ALLOPHONE TABLE

Allophone	Sample Word	Duration
P1		10 MS
P2		30 MS
P3		50 MS
P4		100 MS
P5		200 MS
✶A	HaT	100 MS
AA	BeiGE	280 MS
✶E	eND	70 MS
EE	See	250 MS
✶I	SiT	70 MS
II	SKy	260 MS
✶O	HoT	100 MS
OO	Beau	240 MS
✶U	SuCCEED	70 MS
B	bOTTLE	50 MS
BB	bUSY	80 MS
C	cAN'T	120 MS
CC	cOMB	190 MS
D	COULd	70 MS
DD	dO	160 MS
✶F	phONE	150 MS
G	gUEST	40 MS
GG	gOT	80 MS
GGG	WIg	140 MS
H	hE	130 MS
HH	hOE	180 MS
J	DOdgE	140 MS
K	SkY	190 MS
L	lAKE	110 MS
LL	SADDle	190 MS
M	mILK	180 MS
N	THIn	140 MS

Allophone	Sample Word	Duration
NN	nO	190 MS
P	pOW	210 MS
R	BrAIN	120 MS
RR	rURAL	170 MS
✶S	BEst	90 MS
T	PARt	100 MS
TT	tO	140 MS
V	SEvEN	190 MS
W	wET	180 MS
Y	yES	130 MS
YY	yEAH	180 MS
Z	zOO	210 MS
DH	muM	240 MS
DHH	merM	290 MS
OR	STore	330 MS
AR	ALarM	290 MS
YR	CLear	350 MS
OY	Boy	420 MS
OU	LuKE	100 MS
OUU	FooD	260 MS
NG	AnGER	220 MS
OW	ouT	370 MS
✶EH	WarY	120 MS
ER	Fir	160 MS
ERR	Purr	300 MS
✶TH	thIN	180 MS
WH	whIG	200 MS
CH	chURCH	190 MS
SH	shIP	160 MS
✶UH	TooK	100 MS
XR	REPair	360 MS
ZH	AzURE	190 MS

✶ These allophones may be doubled

Remember to separate with a / sign

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TABLE 2 – GUIDELINES FOR USING THE ALLOPHONES

●● VOICED STOP CONSONANTS

/B/ - final position: rib; between vowels: fibber; in clusters: bleed, brown
/BB/ - initial position before a vowel: beast
/D/ - final position: played, end
/DD/ - initial position: down; clusters: drain
/G/ - before high front vowels: YR, IY, IH, EY, EH, XR
/GG/ - before high back vowels: UW, UH, OW, OY, AX; and clusters: green, glue
/GGG/- before low vowels: AE, AW, AY, AR, AA, AO OR, ER; and medial clusters: anger; and final position: peg

●● VOICELESS STOP CONSONANTS

/P/ - pleasure, ample, trip
/T/ - final clusters before SS: tests, its
/TT/ - all other positions: test, street
/C/ - before front vowels: YR, IY, IH, EY, EH, XR, AY, AE, ER, AX; initial clusters: cute, clown, scream
/K/ - final position: speak; final clusters: task
/CC/ - before back vowels: UW, UH, OW, OY, OR, AR, AO; initial clusters: crane, quick, clown, scream

●● NASAL

/N/ - before front and centre vowels: YR, IY, IH, EY, EH, XR, AE, ER, AX, AW, AY, UW; final clusters: earn
/NN/ - before back vowels: UH, OW, OY, OR, AR, AA
/M/ - milk, alarm, ample
/NG/ - string, anger

●● SILENCE

P1 (10 MS) - before BB, DD, GG, and JH
P2 (30 MS) - before BB, DD, GG, and JH
P3 (50 MS) - before PP, TT, KK, and CH, and between words
P4 (100 MS) - between clauses and sentences
P5 (200 MS) - between clauses and sentences

●● AFFRICATES

/CH/ - church, feature
/J/ - judge, injure

*THESE ALLOPHONES MAY BE DOUBLED

●● VOICED FRICATIVES

/V/ - vest, prove, even
/DH/ - word-initial position: this, then, they
/DHH/- word-final and between vowels: bathe, bathing
/Z/ - zoo, phase
/ZH/ - beige, pleasure

●● VOICELESS FRICATIVES

*/F/ -)
*/TH/-) These may be doubled for initial position and used singly in final position
*/S/ -)
/SH/ - shirt, leash, nation
/H/ - before front vowels: YR, IY, IH, EY, EH XR, AE
/HH/ - before back vowels: UW, UH, OW, OY, AO, OR, AR
/WH/ - white, whim, twenty

●● RESONANTS

/W/ - we, warrant, linguist
/R/ - initial position: read, write, x-ray
/RR/ - initial clusters: brown, crane, grease
/L/ - like, hello, steel
/Y/ - clusters: cute, beauty, computer
/YY/ - initial position: yes, yarn, yo-yo

●● LONG VOWELS

/EE/ - treat, people, penny
/AA/ - great, statement, tray
/II/ - kite, sky, mighty
/OY/ - noise, toy, voice
/OU/ - after clusters with YY: computer
/OUU/- in monosyllabic words: two, food
/OO/ - zone, close, snow
/OW/ - sound, mouse, down
/LL/ - little, angle, gentlemen

●● R–COLOURED VOWELS

/ER/ - letter, furniture, interrupt
/ERR/- monosyllables: bird, fern, burn
/OR /- fortune, adorn, store
/AR/ - farm, alarm, garment
/YR/ - hear, earring, irresponsible
/XR/ - hair, declare, stare

●● SHORT VOWELS

*/I/ - sitting, stranded
*/E/ - extent, gentlemen
*/A/ - extract, acting
*/UH/- cookie, full
*/EH/- air,
*/U/ - lapel, instruct
*/O/ - pottery, cotton

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HINTS FOR USING THE ALLOPHONES

We have designed the allophone table in such a way that you can quickly and confidently expect to produce excellent speech in a very short time. Remembering the allophones provides you with the quickest method of producing results and in most cases you will find that there is no need to continually refer to the table as you progressively improve your ability to manipulate the allophones.

There will be, however, occasional instances in which the apparently correct allophones do not produce the required word. It is here that one has to experiment, often with some highly unusual or improbable allophones from the master list, and to illustrate these conditions there are a number of alternatively programmed words below. Try them and see the difference! Place them on the same line and separate each alternative with a pause.

P/R/EE/S/I/SH/U/N/	—looks correct	))PRECISION
P/ER/E/S/I/SH/U/N/	—sounds correct	)
B/ER/G/A/N/D/EE/	—looks correct	))BURGUNDY
BB/EER/GGG/ER/N/DD/EE/	—sounds correct	)
L/E/NG/TH/	—sounds poor	))
LL/E/N/TH/	—sounds correct	)LENGTH)
LL/E/N/C/TH/	—sounds correct	)
V/E/ER/I/F/II/	—sounds poor	))
F/E/ER/I/F/II/	—sounds poor	)VERIFY)
V/ER/I/F/A/II/	—sounds correct	)
H/ER/CH/	—sounds poor	))
CH/ERR/CH/	—sounds similar	)CHURCH)
CH/ER/CH/	—sounds correct	)

N.B. (FUNC 3) Should you find that when you input allophones and complete a line there is no answering sound do not be alarmed; this is an operating characteristic. Delete once and retype "/" if you wish. Sound effects may be created by concatenating a series of allophones of varying length.

e.g. D/D/D/D/D/ G/G/G/G/G/ K/K/K/K/K/ Z/Z/Z/Z/Z/ M/M/M/M/

TABLE 3 – SPELLING IRREGULARITIES

	One Sound to Many Letter Representation	Many Sound to One Letter Representation
VOWELS	meat feet Pete people penny	vein foreign deism deicer geisha
CONSONANTS	ship tension precious nation	although ghastly cough

TABLE 4 – EXAMPLES OF WORDS MADE FROM ALLOPHONES

DD/P1/O/O/TT/ER/	"daughter"
C/O/L/II/P1/D/	"collide"
S/S/I/S/TT/ER/	"sister"
C/L/OW/N/	"clown"
CC/UH/C/EE/	"cookie"
L/E/TT/ER/	"letter"
L/I/TT/LL/	"little"
U/NG/CC/LL/	"uncle"
C/O/M/P/Y/OU/TT/ER/	"computer"
E/CC/S/TT/E/E/N/T/	"extent"
TT/OUU/	"two"
A/LL/AR/P1/M/	"alarm"
S/CC/OR/	"score"
F/ERR/	"fir"

Scannen0011.jpg

HEAR ALL THE ALLOPHONES

```
1 PRINT""
2 PRINT"I WILL LET YOU HEAR   EACH ALLOPHONE
3 FORA=0TO2000:NEXT
4 V=40959:DIMA$(64):DIMB$(64)
5 GOSUB1000
10 FORA=5TO63
11 PRINT"":PRINT:PRINT:PRINT"  ALLOPHONE # "A
12 PRINT:PRINT:PRINT"        NAME    "A$(A)
13 PRINT:PRINT:PRINT"SAMPLE WORD    "B$(A)
18 FORK=0TO2:WAITV,1:POKEV,A:WAITV,1:POKEV,0
31 IFPEEK(203)><64 THEN31
33 FORL=0TO600:NEXT:NEXT:NEXT
90 FORJ=0TO7000:NEXT
100 FORH=0TO23:READI:WAITV,1:POKEV,I:NEXT
999 END
1000 FORF=5TO63:READA$(F):NEXT
1030 FORG=5TO63:READB$(G):NEXT:RETURN
2000 DATA/OY/,/II/,/E/,/CC/,/P/,/J/,/N/,/I/,/TT/
2010 DATA/R/,/U/,/M/,/T/,/DH/,/EE/,/AA/,/D/,/OU/
2015 DATA/O/,/A/
2020 DATA/YY/,/EH/,/H/,/B/,/TH/,/UH/,/OUU/,/OW/
2025 DATA/DD/,/GGG/
2030 DATA/V/,/GG/,/SH/,/ZH/,/RR/,/F/,/K/,/C/,/Z/
2035 DATA/NG/,/L/
2040 DATA/W/,/XR/,/WH/,/Y/,/CH/,/ER/,/ERR/,/OO/
2045 DATA/DHH/,/S/,/NN/,/HH/,/OR/
2050 DATA/AR/,/YR/,/G/,/LL/,/BB/
2500 DATABOY,SKY,END,COMB,POW,DODGE,THIN,SIT,TO
2510 DATARURAL
2550 DATASUCCEED,MILK,PART,THEY,SEE,BEIGE,COULD,TO
2555 DATAAUGHT
2560 DATAHAT,YES,WARY,HE,BUSINESS,THIN,BOOK,FOOD
2570 DATAOUT,DO,WIG,VEST
3000 DATAGOT,SHIP,AZURE,BRAIN,FOOD,SKY,CAN'T
3010 DATAZOO,ANCHOR,LAKE,WOOL,REPAIR,WHIG,YES
3015 DATACHURCH,FIR,FIRR,OH,THEY,VEST,NO,HOE
3020 DATASTORE,ALARM,CLEAR,GUEST,SADDLE,BUSINESS
4000 DATA27,7,45,53,4,16,6,11,20,16,3,12,38,2,50
4010 DATA24,13,51,2,63,23,55,55,0
```

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ALTERNATIVE SPEECH GENERATION

Users may be interested to try this mode of operation. The method of programming speech using this mode relies on the user becoming acquainted with the allophone list on pages 18/19. It requires the user to be more patient and may take longer to construct speech than the previous mode does, but it is still possible to draw upon an infinite vocabulary when you manipulate the allophones.

Press RUNSTOP RESTORE or type SYS41003 to disable the existing software. For a return to previous mode refer to SYS commands on page 7. For example, a word such as "answer" would be voiced by typing in 26,11,55,52. However, just entering those numbers as they stand will not initiate any sound. The procedure for entering the chosen word or words is to provide the following program format:

```
100   FOR A=Ø TO 23
110   READ D
120   WAIT 40959, 1
130   POKE 40959, D
140   NEXT A
150   DATA 27,7,45,53,4,16,6,11,20,16,3,12,
           38,2,28,24,11,43,53,4
HELLO      27,7,45,53
SPACE      4
MY NAME    16,6,Ø,11,2Ø,16
SPACE      3
IS         12,38
BONZO      28,24,11,43,53,4
```

N.B. It is important to put a pause at the end of your chosen allophones to prevent the last allophone continuing. You might decide at this point to voice the short string several times. This may be performed by including the following new lines in the preceding program.

```
 90   FOR B=1 TO 3
145   RESTORE
146   NEXT B
```

Such is the programmability of the module.

WAIT 40959, 1	This is used to ensure that the last allophone has been voiced before proceeding.
POKE 40959, D	D is the databyte for the allophone.

Should you wish to use the words "HELLO", "MY", "NAME", "IS", "VIC" in randomly selective manner, as you would in games software, you must apply the WAIT and POKE routine to each word or words in order to then program in the random selection.

Scannen0012.jpg

CODED ALLOPHONE TABLE

DECIMAL CODE NO	ALLOPHONE	SAMPLE WORD	DURATION
0	P1		10 MS
1	P2		30 MS
2	P3		50 MS
3	P4		100 MS
4	P5		200 MS
26	✶A	HaT	100 MS
20	AA	BeiGE	280 MS
7	✶E	eND	70 MS
19	EE	See	250 MS
12	✶I	SiT	70 MS
6	II	SKy	260 MS
24	✶O	HoT	100 MS
53	OO	Beau	240 MS
15	✶U	SuCCEED	70 MS
63	B	bOTTLE	50 MS
28	BB	bUSY	80 MS
8	C	cAN'T	120 MS
42	CC	cOMB	190 MS
41	D	COULd	70 MS
21	DD	dO	160 MS
33	✶F	phONE	150 MS
40	G	gUEST	40 MS
61	GG	gOT	80 MS
36	GGG	WIg	140 MS
34	H	hE	130 MS
27	HH	hOE	180 MS
57	J	DOdgE	140 MS
10	K	SkY	190 MS
45	L	lAKE	110 MS
62	LL	SADDle	190 MS
16	M	mILK	180 MS
11	N	THIn	140 MS

DECIMAL CODE NO	ALLOPHONE	SAMPLE WORD	DURATION
56	NN	nO	190 MS
9	P	pOW	210 MS
39	R	BrAIN	120 MS
14	RR	rURAL	170 MS
55	✶S	BEst	90 MS
17	T	PARt	100 MS
13	TT	tO	140 MS
35	V	SEvEN	190 MS
46	W	wET	180 MS
49	Y	yES	130 MS
25	YY	yEAH	180 MS
43	Z	zOO	210 MS
54	DH	muM	240 MS
18	DHH	merM	290 MS
58	OR	STore	330 MS
59	AR	ALarM	290 MS
60	YR	CLear	350 MS
5	OY	Boy	420 MS
22	OU	LuKE	100 MS
31	OUU	FooD	260 MS
44	NG	AnGER	220 MS
32	OW	ouT	370 MS
26	✶EH	WarY	120 MS
51	ER	Fir	160 MS
52	ERR	Purr	300 MS
29	✶TH	thIN	180 MS
48	WH	whIG	200 MS
50	CH	chURCH	190 MS
37	SH	shIP	160 MS
30	✶UH	TooK	100 MS
47	XR	REPair	360 MS
38	ZH	AzURE	190 MS

✶ These allophones may be doubled

Scannen0013.jpg

NOTES

1) Any unauthorised modffication of these cartridges voids the guarantee.

2) Only one voice synthesis cartridge may be used at any one time in the VIC. Using a motherboard, memory RAM packs may be used alongside our speech units for further storage allowance.

3) Take care not to drop the units and avoid touching the metal contacts on the connector to prolong unit life.

4) We offer a 12 month guarantee on each product and will replace any defective unit returned to us accompanied by the appropriate sales receipt.

5) If a disc drive is to be used it is essential that the disc drive be turned on before the VIC is powered up.

6) If the module is used with the VIC Programmers Aid Cartridge use SYS 41009 if in F3 Mode.

7) Conflicts **may** arise when used with other cartridges except RAM packs.

ACKNOWLEDGEMENT

Thanks to General Instruments for applications assistance.
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